CHAPTER 21-4 MECHANICAL GUIDELINES

21-4.1 INTRODUCTION . . . . . (21-4) 1
21-4.2 NITROUS OXIDE GUIDELINES . . . . . (21-4) 3
21-4.3 COLOR CODE, SIGNAGE, AND IDENTIFICATION OF BUILDING UTILITY PIPING SYSTEMS . . . . . (21-4) 6
21-4.4 SMOKE DAMPER USE (TOXIC VAPOR CASES) . . . . . (21-4) 7
21-4.5 VENTILATION DESIGN FOR THE INSTALLATION OF TUBERCULOSIS CONTROL BOOTH . . . . . (21-4) 7
21-4.6 VENTILATION DESIGN FOR ISOLATION ROOMS . . . . (21-4) 8
21-4.7 FIRE SPRINKLERS VERSUS ALTERNATE PROVISIONS (QUARTERS) . . . . . (21-4) 9

21-4.1 INTRODUCTION

A. Purpose

The purpose of this chapter is twofold:

(1) To convey to the architect/engineer (A/E), Indian Health Service (IHS) staff, and tribal staff, both general and specific guidelines regarding mechanical design features required for IHS health care facilities and quarters projects including tribal health care facilities.

(2) To inform the A/E, IHS and tribal staff of the requirements for each submittal of the construction documents for approval.

B. Codes and Standards

Design shall comply with:

(1) Codes and Standards required in this chapter and chapters in Volume III of Part 21 “Design Criteria and Standards;”

(2) State and Local codes/ordinances (if this represents a major cost increases, advise the IHS contracting officer and/or tribal contracting officer);

(3) Rules and regulations of the local utility companies; and

(4) The applicable standards of the following organizations:

AABC	Associated Air Balance Council
ABMA	American Boiler Manufacturers Association
ACGIH	American Conference of Governmental Industrial Hygienists
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute

API	American Petroleum Institute
ASA	Acoustical Society of America
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASSE	American Society of Sanitary Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators International
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
DEMA	Diesel Engine Manufacturers Association
HEI	Heat Exchange Institute
HI	Hydraulics Institute
HI	Hydronics Institute
HVI	Home Ventilating Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ISA	Instrument Society of America
MCAA	Mechanical Contractors Association of America
MSS	Manufacturers Standardization Society of the Valves and Fittings Industry
NAPHCC	National Association of Plumbing-Heating-Cooling Contractors
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
NWWA	National Water Well Association
PDI	Plumbing and Drainage Institute
PPFA	Plastic Pipe and Fittings Association
SBCCI	Southern Building Code Congress International
SBI	Steel Boilers Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TEMA	Tubular Exchanger Manufacturers Association
UL	Underwriters Laboratories Incorporated
USDOC	United States Department of Commerce.

This chapter contains major mechanical design guidelines. However, problems arising from specific project conditions not covered herein shall be resolved through the exercise of sound design practices and referenced to recognized standards compatible with those delineated in this chapter.

21-4.2 NITROUS OXIDE GUIDELINES

A. Background

Nitrous oxide has a long history of use and is the agent of choice for induction of analgesia because of its mild effect on the patient and rapid recovery once it is removed from the patient. It is primarily used in dental clinics on young or apprehensive patients as a management tool and in surgical settings with other anesthetic agents. In the private sector, nitrous oxide continues to be used by pediodontists treating difficult patients. However, its use on adult patients by most dentists has been sharply curtailed. Currently, nitrous oxide is also being used as a coolant in cryosurgical units for treatment of certain gynecological and ophthalmological conditions.

In the 1960s and 1970s, there was a growing awareness that long term exposure to nitrous oxide even at low concentrations posed health risks. Among these health risks are spontaneous abortions in females and genetic defects in the children of males who were exposed to low levels of nitrous oxide.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a maximum exposure level to nitrous oxide of 50 parts per million (PPM) time-weighted-average (TWA). To comply with this standard ACGIH recommended that changes be made in the equipment used, the location of use, and the technique of application. Specifically ACGIH recommended the following:

- Designated areas with proper ventilation should be established for the administration of nitrous oxide;
- Scavenging devices should be added to analgesic units; and
- The number of procedures performed during any time period should be reduced.

The Indian Health Service continues to use nitrous oxide in three areas; (1) dental operatories for analgesia, (2) surgeries for anethesia, and (3) treatment rooms for cryosurgery. In the first and second cases, nitrous oxide is used at low pressure under 260 kPa (40 psi). In the third case, to operate the cryosurgical units, nitrous oxide must be delivered at 5200 kPa (750 psi). At the present time, the third case poses the greatest health risk because in some facilities the units are not being vented to the outside.

B. Discussion

Currently, nitrous oxide is made available at locations requiring low pressure delivery in one of two ways:

- by individual portable gas bottles or cylinders that are delivered to and used at the location or
- through a central system consisting of a manifold of gas cylinders and a piped distribution system.

The advantages and disadvantages of each system are as follows:

(1) PORTABLE CYLINDER SYSTEM

- The advantages include the following:
  - lower initial cost,
  - limited volumes which reduce chance of extensive exposure due to leaks, and
  - flexibility.

- The disadvantages include the following:
  - extra security required to prevent pilferage,
  - proper storage required,
  - increased clutter in clinical space,
  - higher cost of small quantity purchases,
  - portability promotes use in improperly ventilated areas,
  - limited volumes may run out during medical and/or dental procedures, and
  - frequent handling of cylinders increases risk of accident.

(2) CENTRAL SUPPLY, PIPED GAS SYSTEM

- The advantages include the following:
  - convenient access in specific areas,
  - inexpensive product,
  - product security increased,
  - auto-switching manifolds provide uninterrupted supply, and
  - simplified supply procedures by single point.

- The disadvantages include the following:
  - alarm systems do not detect slow leaks in check valves which may result in extensive occupational exposure,
  - low pressure piped gas systems will not operate cryosurgical units,
  - higher initial installation costs, and
  - regular surveillance required to detect leakage at outlets.

Note: In any case, facilities that use cryosurgical procedures must have cylinders available because these units operate at 5200 kPa (750 psi).

C. Guidelines

(1) At health care facilities where **low pressure** nitrous oxide is in **three or more** locations, nitrous oxide should be supplied in a piped medical gas system with a multiple cylinder, auto-switching manifold and appropriate alarm systems.

(2) In areas where nitrous oxide is being used to operate cryosurgical units, locations must be monitored to determine the adequacy of environmental controls. The following guidelines must be applied in these locations:

a. Annual monitoring of exposed workers using both short term personal samples and eight hours time-weighted-

average (TWA) samples;

b. Annual preventive maintenance surveys of the cryosurgical units to check for leaks;

c. In existing facilities, where no medical vacuum is available, the cryosurgery procedure should be conducted in a room with an outside wall to allow gravity venting of the device through an open window; and

d. In major renovations or new construction, rooms used for cryosurgery should contain a medical vacuum outlet equipped with a regulator to allow the mechanical venting of the unit.

(3) Before design that includes installation or modification of nitrous oxide, the designer should review the current Indian Health Service Dental Program Operational Manual, Section N20 - 02 Analgesia, pages VII-3 through VII-12.

21-4.3 COLOR CODE, SIGNAGE, AND IDENTIFICATION OF BUILDING UTILITY PIPING SYSTEMS

A. Purpose

This section provides guidelines on color code, signage, and identification of building utility piping systems and physical hazards in Indian Health Service health care facilities and quarters, and/or tribal health care facilities.

B. Reference Standards

The following standards are to be applied during planning, design, and construction, including renovation, improvement, and/or expansion, of all IHS and tribal health care facilities:

(1) Piping - American National Standards Institute latest edition, A13.1, Scheme for Identification of Piping Systems;

(2) Medical Gases Signage - National Fire Protection Association 99 latest edition, Standard for Health Care Facilities, Gas Systems Information and Warning Signs;

(3) Gas Cylinder - Compressed Gas Association Pamphlet latest edition, C-9, Standard Color-Marking of Compressed Gas Cylinderd Intended for Medical Use; and

(4) Physical Hazards - Occupational Safety and Health Act, 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards.

21-4.4 SMOKE DAMPER USE (TOXIC VAPOR CASES)

A. Purpose

This section provides specific guidelines on the life safety requirements for the design of all Indian Health Service (IHS) health care facilities and/or tribal health care facilities.

B. Background

The new Exception No. 2 to Life Safety Code (LSC) dated February 8, 1991, Sections 12-3.7.3 and 13-3.5.3, does not require smoke dampers in duct penetration of smoke barriers in fully ducted heating, ventilating, and air conditioning systems, where an approved, supervised automatic sprinkler system has been provided for smoke compartment adjacent to the smoke barrier. However, toxic vapors and/or smoke can move across smoke barriers without smoke dampers. Based on the National Fire Protection Association studies of fatal fires in health care facilities, most patient deaths result from smoke inhalation. Some fires smolder and produce smoke for several hours before sprinkler heads are activated. Therefore, requiring buildings to be provided with a complete automatic sprinkler system does not guarantee that a fire will be extinguished before toxic vapors and/or smoke are released.

C. Reference Standards

Based on the 1994 Edition of National Fire Protection Association 101, Life Safety Code, Exception No. 2 cited in Sections 12-3.7.3 and 13-3.5.3, will not be used for the design of IHS health care facilities and/or tribal health care facilities.

D. Design Criteria

For IHS health care facilities, smoke dampers shall be used in duct penetrations of all smoke barriers.

21-4.5 VENTILATION DESIGN FOR THE INSTALLATION OF TUBERCULOSIS CONTROL BOOTH

A. Purpose

This section provides guidelines on the design criteria for tuberculosis (TB) control to minimize the risks of TB transmission in IHS and tribal health care facilities. This criteria applies to all existing IHS and tribal health care facilities and will be applied during design and construction of new IHS and/or tribal health care facilities.

B. Design Criteria

The procedures such as the administration of aerosolized pentamidine and sputum induction should be performed in a self-contained booth equipped with a minimum of 10 air changes per hour (ACH) and high efficiency particulate air (HEPA) filters, with a

time interval of 45 minutes between patients treatments. The number of units in a facility will be determined by the hospital infection control committee based on facility needs, and it should be located in the treatment room.

21-4.6 VENTILATING DESIGN FOR ISOLATION ROOMS

A. Purpose

This section provides guidelines to supplement the existing design criteria for isolation rooms and will be applied during design and construction of all new Indian Health Service health care facilities and/or tribal health care facilities.

B. Design Criteria

In addition to existing guidelines on design and construction of isolation rooms, the following criteria will be applied:

(1) Doors shall be provided between corridors and anteroom, and between the anteroom and patient room;

(2) Air mixing devices in the patient room shall be designed to allow air to move from the supply air outlet located at or near the ceiling level, across the occupied space, and then to the exhaust grille located 150 millimeters above the finished floor;

(3) Germicidal ultraviolet lamps shall not be used as a supplemental method of reducing the concentration of infectious droplet nuclei. The effectiveness of such lamps has not been adequately evaluated to permit their being substituted for other engineering controls; and

(4) Acquired Immune-Deficiency Syndrome (AIDS) patients shall not be placed in positively pressurized protective isolation rooms.

21-4.7 FIRE SPRINKLERS VERSUS ALTERNATE PROVISIONS (QUARTERS)

A. Purpose

This section provides guidelines for automatic sprinkler systems (or equivalent) and hard-wired smoke detectors in all Indian Health Service quarters or residential units. The intent is not to override or negate any aspect of the FIRE ADMINISTRATION AUTHORIZATION ACT OF 1992, Public Law 102-522.

B. Design Criteria

In addition to existing guidelines on design and construction of IHS quarters or residential units, the following criteria will be applied:

- Multi-Family Units acquired after October 26, 1992. Provide a fully automatic sprinkler system (or equivalent) and hard-wired smoke detection system for multi-family units of four or more stories above ground level. For all other multi-family units, provide a hard-wired smoke detection system.

- All Other Housing - Provide hard-wired smoke detection system for all existing housing when vacated or not later than October 25, 1995.